

A novel use of ultrasound for the extraction of a fractured umbilical arterial catheter

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ABSTRACT

A 7-day-old 600 grams baby with a post-conceptual age of 29 weeks presented with features suggestive of hollow viscous perforation, and was posted for an emergency laparotomy. In addition, she had a fractured indwelling umbilical arterial catheter which was planned for extraction in the same sitting. Radiological imaging showed that the catheter extended into the stump of the umbilical cord. She underwent exploratory laparotomy and ileal resection anastomosis, following which the stump was explored. However, the catheter could not be identified, and we suspected that it had embolised into the aorta. Using ultrasound guidance, we identified the catheter within the aorta. The aorta was cross-clamped, and the catheter extracted through an aortotomy which was later sutured.

Key words: Catheter embolus, catheter fracture, ultrasound, umbilical arterial catheter

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INTRODUCTION

The first cannulation of the umbilical artery is attributed to Dr. Virginia Apgar in the late 1950's. Today, umbilical arterial catheterisation is the standard of care in the neonatal intensive care unit for arterial blood sampling and continuous blood pressure monitoring. The cannulation is usually done within 5-7 days of birth.^[1]

Risks with these catheters include perforation during insertion, bacterial colonisation, increased incidence of thrombosis and embolism, and occasionally transection.^[2-4] A fragmented retained umbilical catheter acts as a nidus for bacterial colonisation, thrombosis and can embolise and compromise distal vascular beds. This necessitates its retrieval, which can be done endovascularly or through open surgery.

We report a case of a fractured indwelling umbilical arterial catheter (UAC), in a neonate which was located using intra-operative ultrasound.

CASE REPORT

A 7-day-old preterm neonate with a post-conceptual age of 29 weeks and weighing 600 grams was admitted

in the neonatal intensive care unit (NICU). She developed pneumo-peritoneum and sepsis, and was on nasal CPAP for ventilatory support. A 3.5 Fr umbilical arterial catheter was inserted for regular arterial sampling. She stabilised on supportive management, hence, it was decided to remove the umbilical arterial catheter. However, during the removal, the catheter was transected inadvertently, and the distal portion was retained. X-ray imaging showed that the catheter extended till the umbilical stump.

This was initially managed conservatively, but as her condition deteriorated, an emergency explorative laparotomy was planned for the perforation peritonitis and in addition, extraction of the retained umbilical catheter fragment. She was administered 2 µg/kg of fentanyl i.v. and incremental sevoflurane upto 8% to

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induce anaesthesia. Rocuronium was administered in the dose of 1 mg/kg to facilitate tracheal intubation. Left subclavian central venous line (Double lumen Multicath2 VYGON GmbH and Co.KG), was inserted under ultrasound guidance. The perforation was identified, and a primary resection anastomosis of the ileum was done. The umbilical catheter could not be found on local exploration of the umbilical stump. We suspected that the catheter had retracted further into the umbilical artery.

We used a LOGIQ™ e R7 US machine (GE Medical Systems, Milwaukee, WI, USA) with a 12L-RS wide band Linear probe (5-13MHz) to visualise the aorta trans-abdominally in a sagittal plane. The umbilical artery catheter was identified within the lumen as a hyper-echoic double-track structure [Figure 1].

The catheter extended proximally from the thoracic aorta till the bifurcation of the abdominal aorta distally. The infra-renal aorta was cross-clamped for 7 minutes and the catheter was removed by an aortotomy, which was later sutured. Prior to aortic cross-clamping, 100 U/kg of heparin was administered and nor-epinephrine infusion at a rate of 0.1µg/kg/min was started. Following clamp release, 15ml/kg each of packed red blood cells, fresh frozen plasma and platelets were transfused.

The patient was shifted back to NICU, on ventilatory support, for further management. Despite all efforts, the baby succumbed to sepsis related complications on the second postoperative day.

DISCUSSION

Fracture and embolisation of umbilical arterial catheter is a rare occurrence. This usually occurs

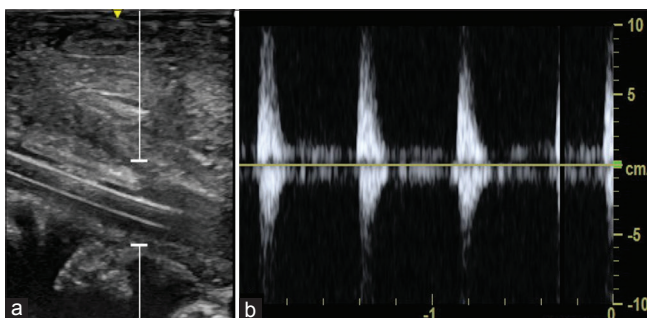


Figure 1: Trans-abdominal visualisation of the aorta using ultrasound. The probe was placed subcostally in a parasagittal orientation. (a) Hyper-echoic double track appearance of the catheter within the aortic lumen. (b) The characteristic waveform of the aorta seen in the continuous wave doppler mode

when the retaining suture is cut with a scalpel blade, inadvertently transecting the catheter. Manufacturing defects and prolonged usage leading to structural damage may be contributory factors.

A literature search revealed 10 case reports of transected UAC.^[5,6] The first report is from 1972, where the catheter fragment was removed from the thoracic aorta by an open approach without complications. The open approach was used successfully in 5 more cases. The endovascular approach is the preferred method for catheter extraction though it may not always be successful. In 2 cases the catheter was successfully removed using an endovascular approach. However in one case a fractured umbilical venous catheter could not be removed endovascularly and required conversion to an open approach.^[7] In another case the catheter fragment was left in place and conservatively managed.^[5,6]

Open retrieval necessitates aortic cross-clamping. This reduces perfusion to distal organs and may lead to ischemia in the spinal cord and the kidneys. Therefore, higher blood pressures should be maintained with inotropic support which may be increased according to need. Blood and products must be at hand, as catastrophic exsanguination leading to cardiovascular collapse can occur. Following cross clamp release, calcium and sodium bicarbonate may be administered. Shorter clamp time would naturally improve outcomes.^[8]

Ultrasound has currently become an indispensable part of the operation theatre environment. It is widely used for inserting vascular cannulae, performing regional blocks and identifying vascular structures. Newer uses for the ultrasound in the operating room environment keep emerging. Assessment of residual gastric volume, predicting endotracheal tube size before intubation, difficult airway assessment and intra-operative lung ultrasound are just to name a few.^[9] Ultrasound can guide intra-operative decisions by real-time delineation of tumour margins and enables navigation of vascular structures to reduce blood loss during surgeries.^[10,11]

In our patient, initially an exploratory laparotomy and ileal resection anastomosis was performed. Following this, the umbilical stump was explored unsuccessfully in search of the fragmented catheter. The intra-abdominal portion of the umbilical artery was palpated, but the umbilical artery being soft, precluded identification by this method. Ultrasound

could not identify the catheter within the umbilical artery. Therefore, suspecting that the catheter had embolised, we visualised the aorta trans-abdominally in the sagittal plane. The intraluminal double track appearance of a vascular catheter confirmed that the catheter had embolised.

Ultrasound has been used in the past in identifying embolised intravascular catheter fragments in arteries, veins and the heart.^[6,12,13] However, it has not been used as a sole modality in identifying and delineating extent in real-time of an embolised catheter, which led to successful recovery of the fragment. This highlights a novel use of the ultrasound as an integral adjunct in similar procedures.

CONCLUSION

Fracture and embolisation of a UAC is a rare but serious complication. The ultrasound is a novel device in the anaesthetist's armamentarium and its use in the operating room is in constant evolution. This case report highlights the possible utility of ultrasound beyond its traditional use in venous access and regional blocks and as an unconventional aid in patient management in various scenarios.

Consent for publication

Consent for publication has been obtained from the parents.

Declaration of patient consent

The authors certify that they have obtained all appropriate consent forms. In the form the parents have given their consent for their child's images and other clinical information to be reported in the journal. The parents understand that their child's name and initials will not be published and due efforts will be made to conceal their child's identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There are no conflicts of interest.

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